Chapter 4

First Solar Case – Competitive Pressure, Growth and Rate of Return

Conceptual Valuation Errors Made in the First Solar Case

In describing various bungled valuation analyses, a mixture of corporate and project finance cases are used to demonstrate similarities and differences in valuation errors made in assessing all sorts of investments. The case study of First Solar Corporation discussed in this chapter involves valuation issues in corporate finance in contrast project finance which was used in the Petrozuata case. At the time the case was written in 2010, the company was one of largest solar panel producers in the world. First Solar's stock price had already experienced a large decline after the Lehman collapse in 2008-2009 and management was considering new strategies after growth prospects for the sale of panels was dimming in Europe. The primary strategic initiative chosen by the company was to use First Solar's manufacturing skills in order to become vertically integrated, meaning that First Solar would develop, construct, own and operate projects over their lifetime as well as continuing to manufacture panels. Despite very positive comments about the company made in the case write-up, the new strategy did not work. In a couple of years after 2010 the strategy had failed. Prices of solar equipment plummeted; First Solar's stock price did not recover, but instead declined by another 80%. The company took large write-offs for restructuring; goodwill associated with companies acquired to enter into the development business was all impaired; and, the top management touted in the case write-up was replaced.

The basis for discussion of the case discussion is a write-up by Stanford University titled "First Solar, Inc. in 2010".[1] A similar case was published in 2009 by HBS that discussed NanoSolar, a company that manufactured panels using the same technology as First Solar called thin film and was experiencing the same

[1] Hallmon, Morgan, Siegel, Robert and Burgelman, Robert "*First Solar, Inc. In 2010*", 10/01/10, by the Board of Trustees of the Leland Stanford Junior University.

type of challenges as First Solar.[2] Both of these case write-ups provide a general background on solar power as well as discussion of corporate strategy and finance. Additional sources of information for the discussion of First Solar in this chapter include a series of ValueLine reports for the company that illustrate how investment analysts sometimes compute equity value as well as First Solar annual reports to shareholders. As with the HBS cases, the Stanford First Solar case is very complementary of management. Some of the laudatory phrases written by the authors of the case write-up include: "…accomplishments had indeed been impressive", "the remarkable achievements of the exceptional people…", "the industry leader…", "…prowess in manufacturing", and, "financial performance had been impressive..." The First Solar case as well as the HBS NanoSolar cases even include resumes of key management in an appendix. Nanosolar, the company that is subject of the HBS write-up, experienced a worse fate than First Solar. Nanosolar ceased its operations and lost just about all of the money invested by its shareholders. By February of 2013 Nanosolar had laid-off 75% of its work force and it was auctioning off its equipment in August of 2013.

The primary issue in the case write-up involved a new management strategy at First Solar in response to changes in the industry. The general idea was that the company could maintain its shareholder value by entering the development, construction and operation segments of the solar industry through leveraging its manufacturing abilities. In the case write-up, thin film production of solar panels applied by First Solar was asserted to be superior to competing polysilicon technologies. The superior manufacturing technology would enable the company to compete with other kinds of electricity generation without subsidies. To implement the strategy, First Solar acquired a series of development companies that were in various segments of the downstream business and it paid substantial premiums relative to book value.

From a valuation perspective, the question addressed here is whether the fall in the equity value of First Solar that happened after 2010 was predictable or whether the fate of the company was due to random events that could not have been forseen. Analysis of the industry and the company demonstrate that with hindsight, the valuation of solar manufacturing companies in general and First Solar in particular and made by investment analysts was not reasonable before 2010. Financial statements of the company and the competitive structure of the solar panel manufacturing industry implies that there were many conceptual valuation errors in evaluating First Solar as well as the entire solar manufacturing industry. Some of these errors discussed in the chapter include:

- Not considering competitive pressures when making valuations that assume high returns can be earned along with high growth in commodity industries.

[2] Steenburgh, Thomas J. and Wagonfeld, Alison, "Nanosolar, Inc." OCTOBER 15, 2009, Copyright © 2009 President and Fellows of Harvard College.

- Failure to use simple models that differentiate long-term prospective return from growth when evaluating prospective cash flows and evaluating multiples such as the P/E ratio and the EV/EBITDA ratio.
- Assuming that economic rents generated from government subsidies can be replaced by high returns from de-regulated markets.
- Valuations that accept potentially overconfident management beliefs that it can change its strategy and maintain high returns when it enters new businesses.

Synopsis of the First Solar Case

As a context for understanding valuation of First Solar and other companies that experienced difficulties after 2010, it is instructive to understand the difference between corporate finance and project finance. The way you can think about corporate finance versus project finance is to think about the amorous relationship analogy discussed in Chapter 3 versus prospects of a family or a city. The amorous relationship presented as an analogy to project finance had a defined beginning, when the first development expenditures (or money for dinner dates) were made. In the case of a city, a family or a corporation, such a beginning is not so easy to identify. The city of Detroit began at some time when Native Americans inhabited the area and BMW Corporation also began a long time ago as did your family. As such, whereas the amorous relationship or project finance has no history, the corporation does have a history. In studying the prospects for your family or the City of Detroit it would be a big mistake not to begin by understand its history. For a corporation, the history can be understood by examining financial statements and making some sort of statistical analysis of the numbers. When projecting the future for your family and potential ups and downs it may experience over the years, you must also understand the strengths and weaknesses of different children, parents and grandparents as well as the external environment in which the family lives. As the family, the city and the corporation does not have a definitive end, the future prospects cannot be evaluated over the entire remaining life of the entity. This is unlike the project finance where the assessment of the project success ends when the relationship is ends, as all ultimately do. This little comparison between project finance and corporate finance is intended to point out that in corporate finance you must study history and come up with some way to value an indefinite life.

First Solar's roots and history were in production of automotive glass in Toledo Ohio in the 1980's. It began large scale solar panel operations in 1999 to construct photovolatatic ("PV") panels using thin film technology that had a base of glass upon which a special chemical that was a semiconductor -- cadmium

telluride ("CdTe") – was coated. The company reached profitability and went public in 2006, a couple of years after aggressive solar subsidies were established in Germany that provided guaranteed fixed prices called feed-in tariffs. At the time of the case write-up in 2010, First Solar was not the only thin film manufacturer, but it was considered the industry benchmark for this type of manufacturing process using glass as a base. After the global financial crisis in 2008, the solar manufacturing industry began to have some difficulties as European countries which had been the drivers of solar power reduced subsidies and as debt financing for solar power projects became more difficult. Figure 4.1 demonstrates that from 2008 to 2010, First Solar's stock price had fell more than half after the Lehman collapse. But this decline was subsequent to a meteoric rise providing investors who bought the stock in 2006 with 12 times their investment.[3] Relative to the stock price at the IPO date, the current price was still almost six times as high by the end of 2010.

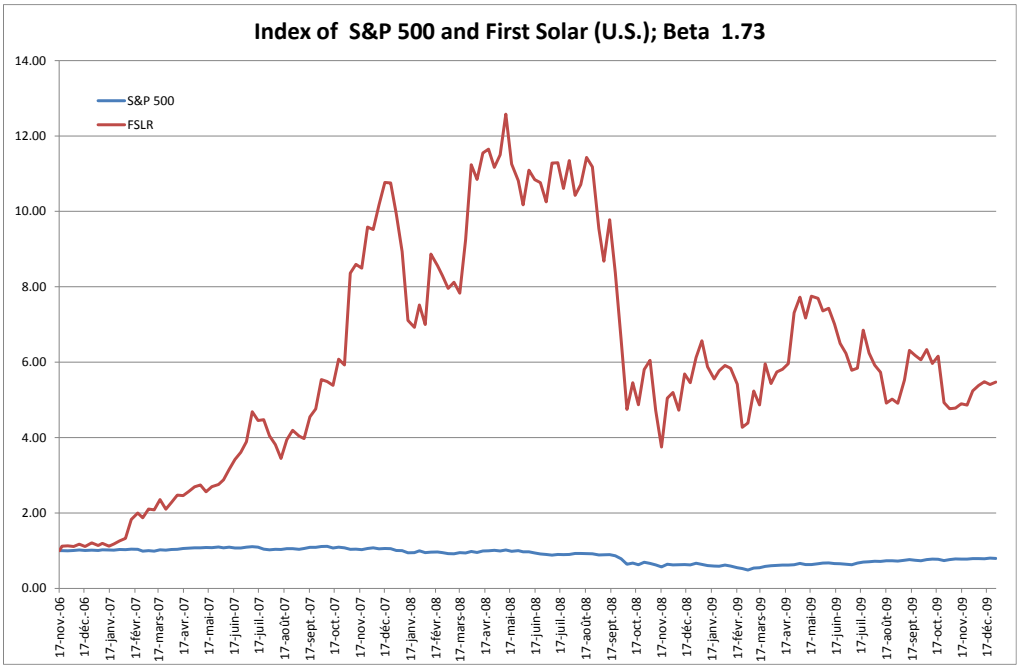


Figure 4.1 – First Solar Stock Price from IPO in 2006 Until 2010

In addition to discussing First Solar's strategy, the case write-up includes a history of the solar power industry that describes the panel (or cell) production process; subsidy and pricing schemes (feed-in tariffs, PPA agreements, capital subsidies and renewable energy credits); grid parity possibility meaning the point at which solar power can compete with retail and wholesale power rates; balance

[3] This graph as well as other stock price graphs are made from files that can be found on the website www.edbodmer.com.

of system costs that include inverters, wiring, labor, racks and engineering. The case write-up compares the thin-film production process to the more common polysilcion technology, the solar value chain and the financial performance of the company.

Before 2008, companies in the solar manufacturing industry seemed to be an attractive investment and First Solar was surely one of the premier companies. The solar manufacturing companies were earning high returns and growing at very quickly. Even though solar power represents a very small portion of overall electricity production, it had been and continues to be a high growth industry. The problem was that growth of the industry had been driven by subsidies as solar power could not compete with the price of electricity sold in wholesale markets. The high cost of solar power was driven by: (1) the fact that the sunlight does not produce the same amount of energy over the course of the year and over the course of a day meaning that the capital cost of equipment must be spread over a limited units produced; (2) the relatively high capital cost of an installed system including panels, wiring, inverter costs, racks and labor (in 2010 the cost per kW of maximum power output was more than an expensive coal plant); (3) the cost of capital, as solar power from PV is probably just about the most capital intensive endeavor on earth with virtually all of its costs represented by up-front capital; and (4) operation and maintenance costs that should be modest and require cleaning of panels at night time as well as insurance, inverter replacement and administrative costs.

Government policies involving the subsidy structure in Germany did arguably lead to a revolution in the solar industry and it can be used as an example of effective government policy. Germany had offered a highly subsidized feed-in tariff for solar production when it started its program in 2004 meaning that money received from "feeding-in" solar power to the grid was almost 10 times the price of wholesale power. This high feed-in tariff was designed to spur the industry to attain scale that would reduce unit cost as un-subsidized markets would not enable companies to have the patience to increase production capacity. The feed-in tariff was a simple flat price available to anybody and it did not change with inflation or electricity prices. This fixed price had an important effect of reducing the cost of capital for the projects by allowing predictable cash flow. There was no need to negotiate complex purchased power agreements ("PPA") and the tariff was not limited to selected corporations. And the German policy worked. As shown in Figure 4.2, the feed-in tariff was able to be dramatically reduced to the point where it is almost competitive with conventional technologies. The tariff had spurred new industry capacity and the increasing scale led to lower per unit (per kW) costs of all sorts of equipment. Individual companies such as First Solar were touting their unique skills and their abilities to reduce manufacturing cost over the period. In fact the whole industry was reducing costs at a reasonably constant rate.

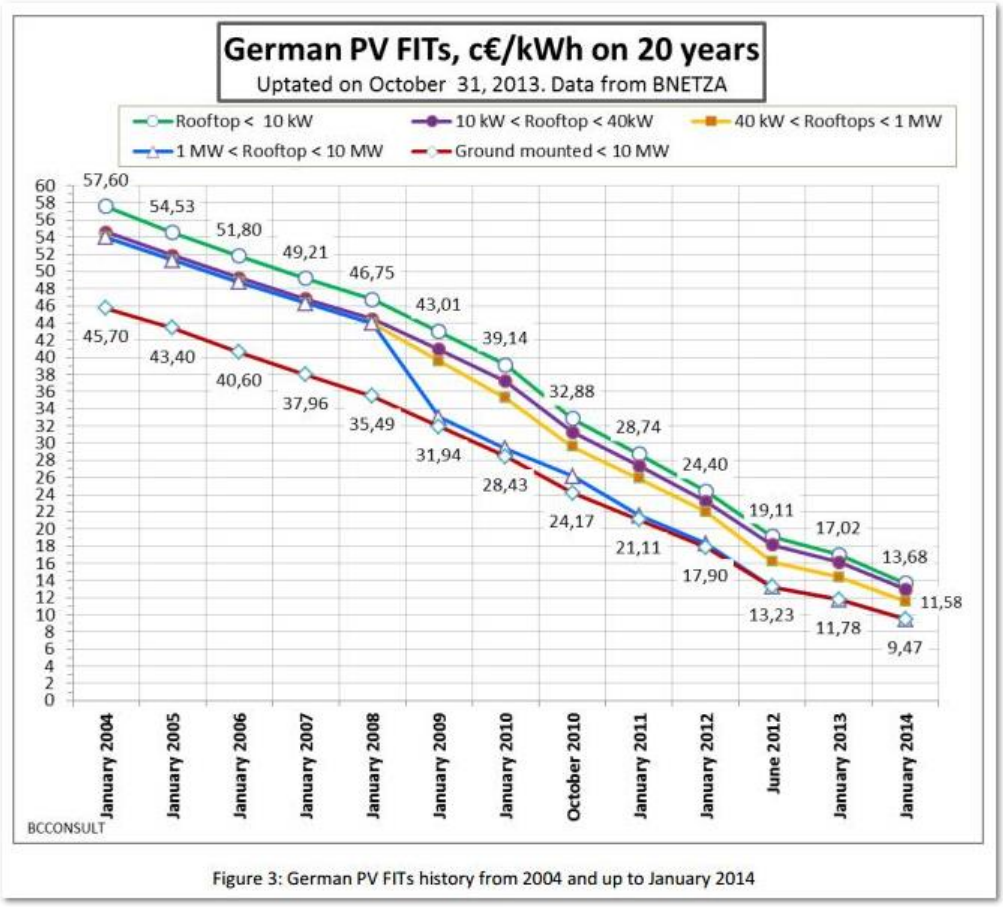


Figure 4.2 – German Feed-In Tariffs from 2004-2014

The Stanford write-up of First Solar included general discussion of the levelized cost of electricity that is supposed to put together the various drivers of total cost and compare solar power to other technologies. The levelized cost of electricity (LCOE) has some similarities to the production cost of oil discussed in Chapter 3 and is frequently used as a benchmark in the industry to evaluate projects. It may seem like some kind of complicated statistic, but it is just the weighted average nominal price of electricity over the lifetime of a facility. In weighting the price, the amount of power production as well as the time value of money are both implicitly considered in the calculation. As the levelized cost measures average cost over the life of a project adjusted for a given discount rate and is better to expressed in real terms as the current production cost of electricity. Computations of the LCOE and production cost are described in an associated video.

While the LCOE calculations include capital costs, operating cost, capacity factor and the capital recovery factor, the statistic does not account for certain controversial items associated with renewable energy. Comparisons made using

the LCOE are not adjusted for dispatchability nor the ability to quickly adjust to changes in demand. The LCOE does not typically include the costs of storage that may be necessary for off-grid systems. Issues listed in the case write-up involving LCOE included whether solar power could be competitive with other sources and the competitive advantage of the thin-film panels produced by First Solar relative to other panels made from silicon (refined sand) that are now often produced in China.

In calculating the LCOE discussed in the case, many of the necessary inputs can be approximated from public sources on the internet. The starting point in a solar project analysis is how much land will be available. To illustrate the amount of land required for solar power, a football pitch is assumed. The size of the Stade de France pitch is 105 meters long by 70 meters wide. The electric capacity from solar power for the 7,350 meters squared is determined by assuming that 1,000 watts of solar irriadiation per meter squared occurs under what is termed standard testing conditions (STC). Because Paris is far north of the equator, 1000 watts per meter squared does not occur in Paris even on the sunniest day of the year (the maximum irriadiation on a day that is not cloudy depends on the latitude of the location).[4] Once the size of the site is established, you can get reasonable estimates of the amount of average irradiation per year per square meter from various sources that gauge the solar energy from public websites.[5] For Paris, the average irriation every hour is about 124 watts per meter squared implying that before adjustments, the gross capacity factor is 12.4%.

The solar resource establishes the amount of energy you can generate over the course of the year relative to the maximum capacity of the solar panels dictated by the STC. The amount of energy produced from the sunlight depends on the efficiency of the panels which defines the capacity that is expressed as the kilowatts at peak conditions or kWp. The energy production in kWh must account for actual sunlight and must be subsequently adjusted for the tilt of the panels, degradation[6], dust, snow and sand on the panels, as well as temperature and other losses related to inverters that convert power under direct current which is the basis for kWp into electricity hat can be transmitted to the electricity grid that is measured with alternating current (AC). The amount of the losses from temperature and other factors relative to the theoretical amount of power that could be produced without the losses is termed the performance ratio. In the Paris Stade de France example, with an efficiency of 15% and a performance ratio of 90%, the energy production would be 7,350 meters squared x 124 watts per meter squared x 8,760 hours per year x 15% efficiency x 90% performance ratio. This results in 1,079,270 kWh. Assuming an average domestic use of 600 kWh per

[4] In Chicago, for example, the maximum level of irriadiation of 1,000 from 1991 to 2010 was _____. Chicago has a longitude of 41.87, -87.63. Paris has a latitude 48.85. Key West is 24.55.

[5] Sources include www.rescreen.com, www.pvwatt.com, and www.jc.eu.

[6] Typical assumptions are that the output decreases by 1.5% in the first year and .4% for each year thereafter.

month, energy from the panels would be enough to power 150 houses (1079,270/7,200).

With the resource and the performance ratio established, the economics and LCOE can be computed from the capital expenditures, operation and maintenance cost and carrying charges. The case write-up notes that solar panels were becoming more of a commodity. This is verified by a website called PV Insight lists the cost of panels (as well as the price of silicon). Industry benchmarks can be used for the cost of equipment other than panels (known as balance of plant) and for operation and maintenance. Finally, the cost of capital must be input that depends on required IRR, interest rates, debt terms, inflation rates and taxes. Using public data and different cost of capital estimates, the range of production costs from solar power is shown in Figure 4.3. As with other analytical tasks, details of the production cost calculation can be reviewed with a video at www.edbodmer.com. The progression charts in Figure 4.3 moves from an assumed project in Paris with a high cost of capital and low solar resource, to a project in with good solar resource and a low assumed cost of capital in the Chile desert (Calama). Analysis in Figure 4.3 is meant to demonstrate that computation of the production cost from solar power is not too complex and that it is highly dependent on the cost of capital. These costs are dramatically lower than the LCOE presented in Appendix 2 of the First Solar case write-up.

INSERT FIGURE 4.3

Once issues associated with the overall solar power industry are addressed, the difference between the thin film technology of First Solar is contrasted to the more common polysilicon technology in the Stanford case write-up. This involves assessing the position of First Solar in terms of manufacturing cost relative to other manufacturing companies and the relative costs and benefits of characteristics such efficiency. The primary competing technology to First Solar and the standard technology in the industry were Polysilicon panels. These panels are made by essentially sawing silicon or refined sand (which is a semiconductor and can produce electricity using the photovoltaic process) into thin square panels. The type of modules produced by First Solar, thin film panels, did not require silicon.[7] Polysilicon or c-Si panels had represented about 80% of the market in 2010 and the trend continued in subsequent years. Even though the thin film panels need substantially less raw material because the process involves coating a thin layer of semiconductor material on top of a substrate or base material such as glass, they had a lower efficiency in terms of producing sunlight irriadiation (measured in kWh) into electricity energy (also measured in kWh). The lower

[7] A module represents perhaps twelve panels and an array may have 50 modules.

efficiency means that more panels, sunlight and land were required to generate the same amount of electricity. This can increase operation and maintenance, land payments, wiring and other costs.[8]

The Stanford case study write-up which was so complementary of First Solar suggested that the First Solar's thin film technology had an inherent cost advantage as compared to the polysilicon manufacturers: "[t]he simplicity of CdTe chemistry allowed its capital costs per watt of production to be substantially lower than that for competing technologies." This cost advantage is supposed to come from the high capital expenditures required to refine silicon and the silicon prices that existed before 2008. But the cost advantage changed dramatically with a drop in polysilicon prices beginning in 2010. In 2008 the price of silicon began to fall dramatically from what arguably was a bubble before 2008. This fall was blamed on surplus capacity in the case write-up, implying that the price would rebound soon after 2010. However, as shown in Figure 4.4, the price of silicon continued to decline. It would be essential to understand the long-run production cost in assessing whether the very high silicon prices could have continued, an issue not discussed in the case. Another question not addressed in the case is how low the silicon price had to be in order for polysilicon to be competitive with thin-film. A third question not discussed is why thin-film represented a small fraction of the market (approximately 20%) if it had such cost advantages. The final realted issue is why companies were new production was using polysilicon when the production process for thin film was "relatively simple." These questions are fundamental in considering whether First Solar's high return on invested capital could be maintained.

[8] According to the public database provided by RetScreen tool, the current efficiency of a First Solar panel ranges between 10% and 12.5% while the efficiency of a polysilicon panel made by Trina Solar panel ranges between 13.75% and 15%.

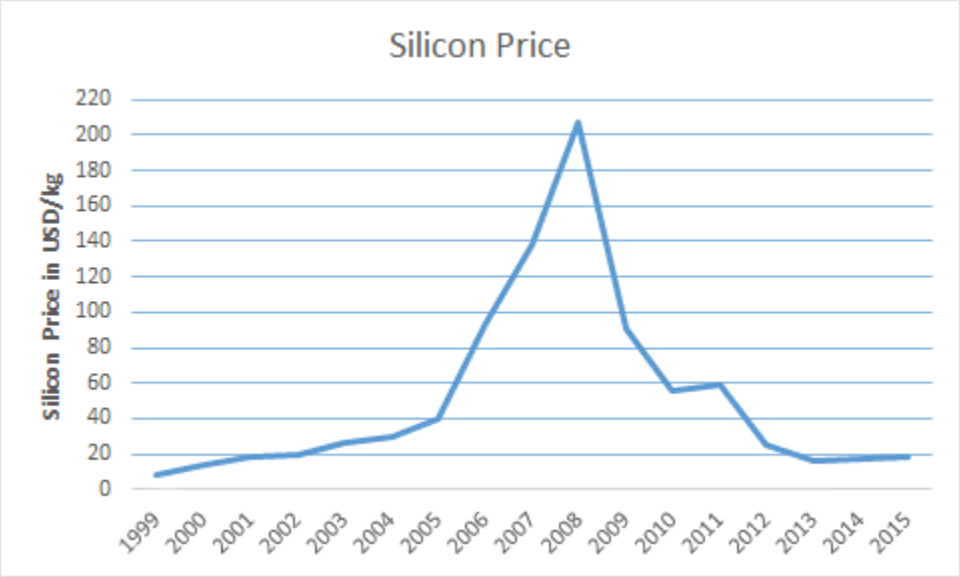


Figure 4.4 – Price of Silicon

The case write-up states that "crystalline silicon (c-Si) prices had dropped precipitously in response to overproduction, substantially reducing the Levelized Cost of Electricity (LCOE) differential between c-Si and First Solar's thin film modules."[9] While there was an increase in industry production capacity, the question is whether dramatic price reductions that occurred over the past few years had been due improvements in productivity, declines in the cost of input materials and reductions in high profits enjoyed by companies or whether it was really due to surplus capacity. Unlike electricity generation assets such as solar projects themselves, the panel production is not very capital intensive. The solar manufacturing process for polysilicon involves a big square building, purchase of raw silicon, equipment that cuts the silicon into pieces, quite a bit of energy and a lot of labor. If there is surplus capacity in the industry, the buildings can be converted to other uses and labor can be quickly dismissed. A solar project on the other hand, involves almost nothing other than capital and very little labor or other costs.

A rough measure of the pricing of solar panels can be obtained from the financial reports of manufacturing companies if you divide reported revenues received by selling panels by the amount of production in MW. When measured on this basis, the approximate price charged per kW from 2006 to 2010 is shown in Figure 4.5. The graph demonstrates that the price charged by First Solar in 2010 was not much different than the price charged by other firms. This price dramatically declined in the subsequent years. By 2015, the price had fallen to as

[9] First Solar, Inc. in 2010, page 2.

low as $400 per kW. [10] Further, by 2010, the there was no clear price advantage for the thin film process relative to polysilicon technology.

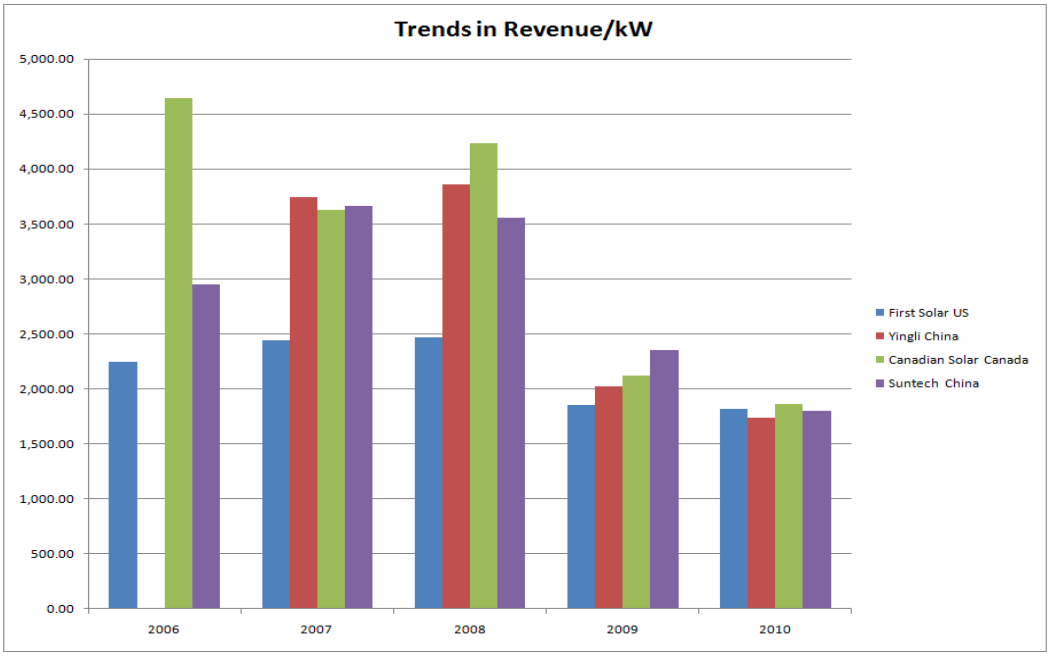


Figure 4.5 – Revenues per kW for Solar Manufacturing Companies from 2006-2010

Nobody wants to be a commodity, neither in your own career nor a corporation. If you are in a commodity business, you cannot differentiate your product and the only way to earn high profits is to be a low cost producer. As the solar manufacturing industry was becoming a commodity business, the case write-up discusses First Solar's move into other activities. The strategy is described in the statement: "Downstream integration could prove a sustainable competitive advantage for First Solar. Specifically, the EPC and development businesses provided higher margin sales channels for the company's modules, and they were more resistant to commoditization."

One year after the case was written, the financial performance of First Solar dramatically deteroriated. The price of polysilicon did not rebound. The company did not produce at full capacity resulting in lower profits and a dramatic reduction in stock price. The First Solar's thin film manufacturing facility in Germany was closed and a new factory in Vietnam was cancelled. In 2011, the company took an impairment write-off for all of the goodwill that had been recorded for its acquisitions of downstream development companies. The failure of First Solar's stock price is illustrated in Figure 4.6 which compares the stock price of solar

[10] Figure 6.2 is derived from annual reports; current costs can be derived from the website www.pvinsight.com

manufacturing companies to the overall market. The graph demonstrates that not only did First Solar's stock price fall along with the other companies, but that its performance was among the worst of in the industry (to be fair, the graph does not show the many other companies that ceased to survive).

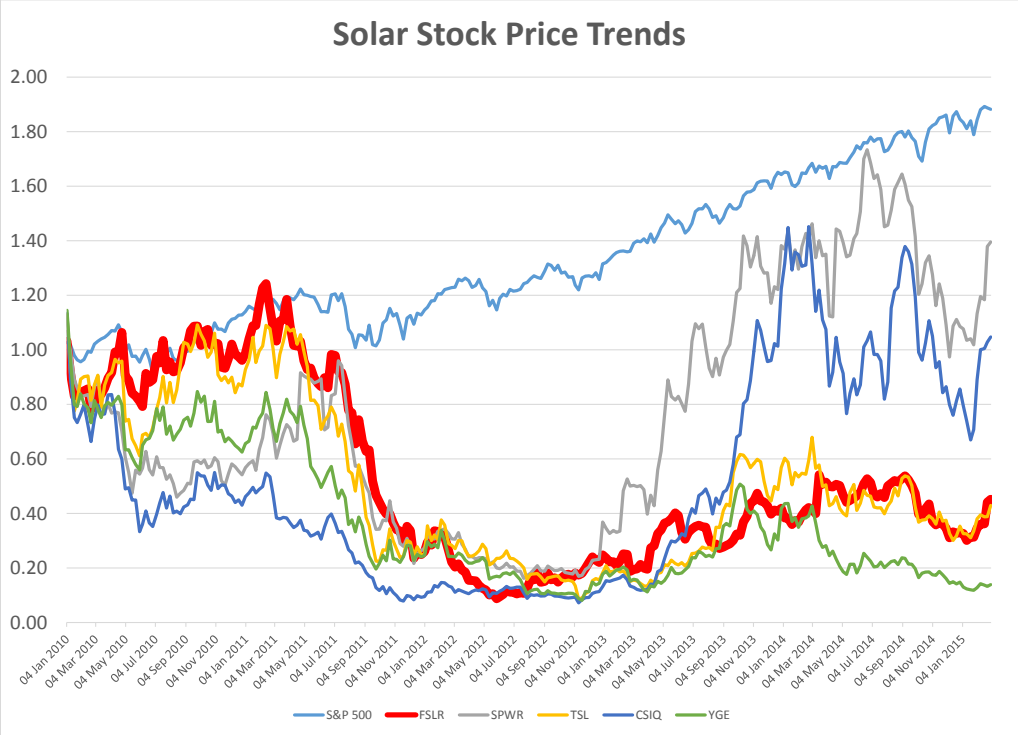


Figure 4.6 – Stock Price of First Solar and Other Solar Manufacturing Companies

Valuation Issues in the First Solar Case

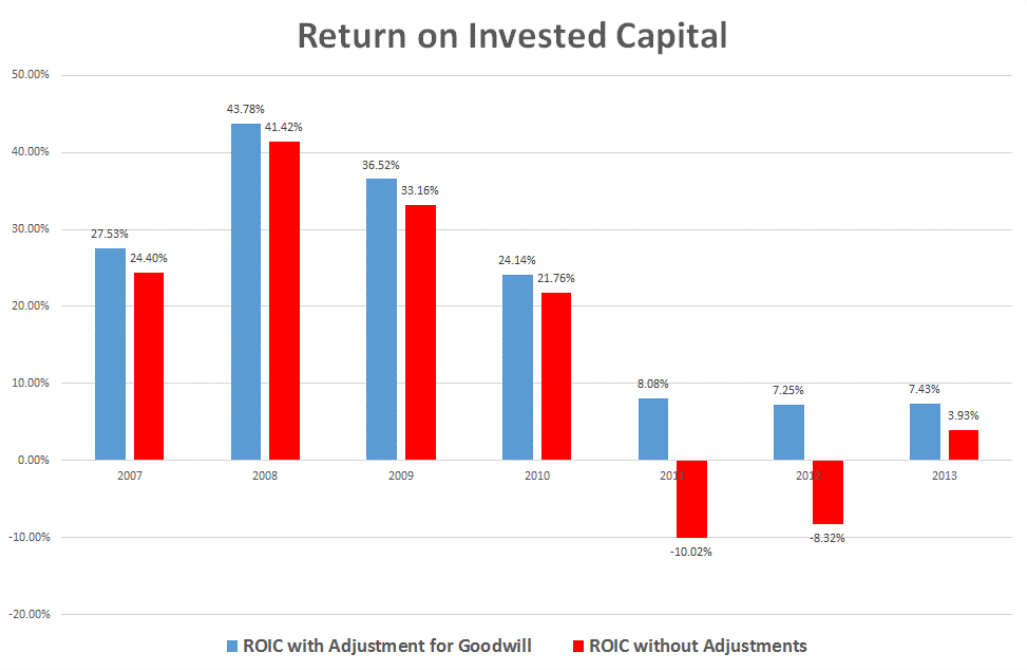
Valuation Error 1: Failure to Evaluate Potential Competitive Pressure with High Returns

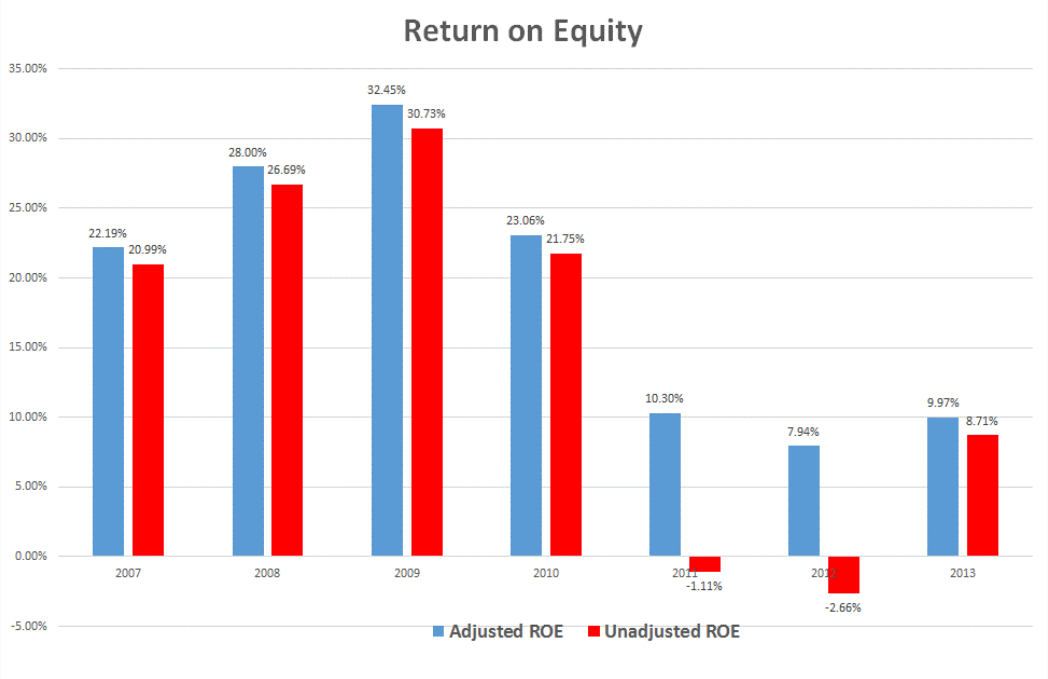
The fundamental objective of any business, whether a corporation or a project financed investment is to earn returns above the cost of capital. For a corporation, as long as the returns that the company earns are above the cost of capital, even more value can be gained for investors by growing the profit making operations. Earning returns above the cost of capital and growing rapidly put a company in the upper right-hand portion of the valuation matrix discussed in

Chapter 2 and illustrated in Figure 2.5. This square with high growth and high return is named the powerhouse square by consultants. For companies that can remain in this powerhouse square, value, the P/E ratio, the EV/EBITDA ratio and the market to book ratio are highest. The problem for many companies is how to stay there.

Before 2010, First Solar seemed to be a classic power house company. In 2008 it had a P/E ratio of 51 times and its stock price had reached $314 per share relative to a book value per share of $18.5 and its IPO price in 2006 of $20 per shear. It was without doubt a fast growing company in a fast growing industry. At the same time First Solar was generating very high returns. Figures 4.7 and 4.8 demonstrate that First Solar was earning a return of above 30% between 2006 and 2009. You do not have to make fancy estimates of the beta to judge that a 40% return is above the cost of capital.

The fundamental issue with assessment of the value of First Solar and the common valuation error made for companies in the powerhouse square is that everybody else wants to be in the same place. Unless there is something very special that limits other companies from entering the business, time in this square can be limited. Motorola was surely in the square when it came out with a portable phone. But it was quickly replaced by Nokia and then Blackberry, followed by Apple and Samsung. From a very basic economic perspective, when new companies enter into industries with companies in the powerhouse square, industry supply increases. After industry supply goes up, surplus capacity becomes a problem, prices can decline to marginal cost and returns drop through the floor. Even without surplus capacity, the desire to enter into the powerhouse square attracts companies that have low cost structure who can effectively compete. This is what is supposed to happen in capitalist economies to push prices to long-run marginal cost. These days with a globalized economy, the competitors could come from anywhere. The most basic question about First Solar that should have been addressed by investors was whether it had some kind of really unique competitive advantage and whether it could maintain the high returns in the face of companies that were entering the business from China.





The return on equity shown on Figure 4.7 includes the effects of financing and activities related to non-core operations while the return on invested capital shown on Figure 4.8 should reflect only the rate of return earned on the fundamental business in manufacturing solar panels and developing solar projects. Return on invested capital is in theory a better measure to use in assessing trends

in profitability of the core business activities, but it is more subjective to compute. A difficult problem in making the calculation is how to treat items that reduce investment on the balance sheet, but do not involve any returns to investment. The difference in measured returns with and without adjustments shown in Figures 4.7 and 4.8 include factors such as goodwill impairment that reduce invested capital, but are not cash outflows and thus do measure the amount of money contributed by investors. An associated video describes the theory of computing returns and why interpretation of the statistics is not a simple matter of plugging various numbers from financial statements into a prescribed formula.

With hindsight, the returns earned by First Solar were not sustainable as shown on Figures 4.7 and 4.8 because of competitive pressure and the many companies from Europe, Asia and North America who were in the industry. A central question in evaluating the valuation process for First Solar after the fact is whether the declines in the rate of return on invested that occurred were predictable. Even if First Solar did have some kind of unique manufacturing process, valuation analysts should have understood that this process could ultimately have been copied. The fundamental policy proposition of programs like the German FIT was to reduce prices. If companies such as First Solar were earning very high returns, the savings were not being passed on the consumers.

Valuation Error 2: Failure to Use Simple Models that Differentiate Growth and Return when Projecting Income and Computing Terminal Value

As a corporation is defined to have an indefinite life, some estimate must be made for the value of a company after a certain period. In valuing First Solar and other companies, the process involves projecting financial statements over a period and then valuing the company from earnings and expected P/E ratios that can be maintained. When First Solar's stock price was $124 per share in July 2011, Value Line Investment Survey expected the earnings to double from $7.68 per share to $14.85 per share and forecast the P/E ratio to rise to 25. Multiplying the price by the P/E ratio implied a price of $372.25. Figure 4.9 illustrates this valuation process and includes projections of the return on equity and return on capital made by an analyst at Value Line. In contrast to the earnings per share forecast of $14.85, actual earnings in 2014 were $3.97 and using the average stock price over the year of $42.32, the implied training P/E ratio was 10.66 rather than the forecast of 25 times.

FIRST SOLAR, INC. NDQ-FSLR — RECENT PRICE 124.65 — P/E RATIO 13.3 (Trailing: 17.8 Median: NMF) — RELATIVE P/E RATIO 0.82 — DIV'D YLD Nil — VALUE LINE

First Solar was founded in 1999 with the goal of applying new technologies to the process of solar power generation. The company initially conducted only research and development operations, until commercial operations began in January 2002. The company went public in November 2006, issuing 22.9 million shares at $20 each, in a deal underwritten by Credit Suisse and Morgan Stanley.

2014-16 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	445	(+255%)	37%
Low	295	(+135%)	24%

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	©VALUE LINE PUB. LLC	14-16
	--	--	--	--	1.06	1.87	6.41	15.27	24.24	29.86	*42.50*	*53.65*	Sales per sh [A]	*84.20*
	--	--	--	--	d.07	.20	1.73	5.00	9.03	9.55	*11.60*	*13.15*	"Cash Flow" per sh	*17.40*
	--	--	--	--	d.14	.07	1.43	4.24	7.53	7.68	*9.40*	*10.70*	Earnings per sh [A B]	*14.85*
	--	--	--	--	--	--	--	--	--	--	*Nil*	*Nil*	Div'ds Decl'd per sh	*Nil*
	--	--	--	--	.94	2.12	3.08	5.63	3.28	6.86	*12.50*	*6.75*	Cap'l Spending per sh	*9.45*
	--	--	--	--	.29	5.69	13.96	18.54	31.13	40.25	*48.50*	*58.65*	Book Value per sh	*81.20*
	--	--	--	--	45.21	72.33	78.58	81.60	85.23	85.84	*88.00*	*89.00*	Common Shs Outst'g [C]	*95.00*
	--	--	--	--	--	NMF	73.1	50.7	19.3	16.5	*Bold figures are Value Line estimates*		Avg Ann'l P/E Ratio	*25.0*
	--	--	--	--	--	NMF	3.88	3.05	1.29	1.06			Relative P/E Ratio	*1.65*
	--	--	--	--	NMF	.9%	9.8%	20.9%	23.0%	18.1%	*18.0%*	*17.5%*	Return on Total Cap'l	*17.5%*
	--	--	--	--	NMF	1.0%	10.2%	23.0%	24.1%	19.2%	*19.0%*	*18.0%*	Return on Shr. Equity	*18.0%*

The overall problem with the Value Line forecast was the assumption that return on capital could be maintained. The first problem was that return on equity and return on capital were not computed in a clear manner from the First Solar financial statements. The second problem is that returns did not decline as discussed in the earlier section. The third problem was that the P/E ratio was consistent with high returns. To illustrate the effect of the optimistic assumptions with respect to returns and multiples, the scenario analysis below demonstrates valuation of the company using a series of different assumptions using different return assumptions. If the trends in return were extended from the historic data . Minor declines in return on capital produced When you look up solar manufacturing companies such as First Solar in financial websites, they are classified as a high technology businesses along with

Show how when have declining returns what happens to returns. Discuss that can make a simple model when returns decline by different levels and assume different terminal values.

Chapter 3 included a discussion of how the IRR can be tricky to interpret for project financed investments. In a similar manner, calculation of return on investment is not necessarily as simple as plugging a prescribed formula or lifting a number from a financial website on the internet. To compute the return on investment that really reflects the value of a company, you may have to dive into the financial statement data. When interpreting the returns of a corporation, you also need to understand some accounting and finance theory as returns are affected by asset age and growth. Measuring the return or the rate of growth in your money for project finance involves computing the IRR from forecasted cash flow that was discussed in Chapter 3.

Discuss valuation from ROIC projections rather than from earnings projections. Also discuss the return on capital and importance of assessing return on capital in forecasts. Differences in measuring returns from different sources. Show table of different valuations with different transition periods, growth rates, returns and cost of capital.

Valuation Error 3: Failure to Interpret Ratios that Measure Market Value to Investment Contribution in Gauging Value

The focus of valuation is generally on the P/E ratio and the EV/EBITDA ratio. A third benchmark, the price to book ratio or the enterprise value to investment value can provide insight.

Discuss the idea of the market to book ratio. Show how First Solar has worse ratio than others. Also note that this is a check on the cost of capital.

In 2010, Value Line Investment projected the stock price in two years to be between ___ and ___ while the current price was ___. A couple months later the pThe case study states that: "[t]he well-developed European ecosystem of developers and systems integrators made the cell and module production business

Growing fast for a company such as First Solar was not so difficult. Companies in general can grow by making acquisitions of other companies or they can spend money on capital expenditures as did First Solar. It is the ability to grow fast and at the same time to continue to earn high returns on the new investments that is the real challenge.

For corporations, the ultimate statistic that measures management performance is the return on investment, which divides the income by a measure of how much money investors have put into the company. The return on investment can be gauged by return on equity or return on invested capital.

Show formula for market to book ratio and discuss implied earnings above cost of capital.

Valuation Error 4: Assuming that High Profits Gained from Government Subsidies could Continue

When you look up solar manufacturing companies such as First Solar in financial websites, they are classified as a high technology businesses along with companies that produce smart phones and semi-conductors. The case study states that: "[t]he well-developed European ecosystem of developers and systems integrators made the cell and module production business model a viable one for First Solar." Translated, this means that each company along the value chain was able to earn high profits when feed-in tariffs were high. The foundation for First Solar returns as well as the returns for other segments of the business were the feed-in tariffs that allow investors to earn high profits. This is analogous to the PPA agreement that allowed Enron to earn a project IRR of more than 20%. Maintenance of this performance required a number of assumptions that were not plausible with hindsight. First, it assumes there would be no political pressure to reverse the policy; second, it assumed that the public would not understand that surcharges that appear on electric bills are not flowing to foreign companies; third it did recognize the risks that subsidies could suddenly disappear. The investment really depended not on the manufacturing process of producing thin film panels, but rather on administrative procedures of European governments. There were stories in Spain of solar producers cheating with measurement of energy fed into the grid and of people seeing container loads of solar panels arriving from China while electric bills.

Not only did Spain eliminate prospective subsidies, but they were changed on a retroactive basis. The analogy grows closer to the Enron Dabhol plant. The amount of production subject to the feed-in tariffs was limited; additional taxes were imposed on owners of the projects and finally the tariffs were adjusted on an individual basis to allow the earning of a regulated return.

Implied that could earn returns from competing against retail rates

Valuation Error 4: Accepting Overconfident Beliefs that it can Change its Strategy and Maintain High Returns

If you read First Solar's annual reports or the Stanford case write-up and believed statements made about the companies abilities, the high returns were due to unusually skilled management and unique manufacturing processes.

Maybe will come back when the price of polysilicon increases. But then would have to assume that nobody else would come into the market.

Given the decline in prices industrywide, a second question is whether First Solar had some kind of manufacturing advantage that meant it could continue making profits while other companies were suffering losses. While the solar industry may seem to be exotic, the general manufacturing procedure involves putting parts together or cutting polysilicon into sections. The process is not very capital intensive (capital intensity can be measured as revenues divided by assets) and the big costs are materials and labor. Unlike coffee, theme parks and smart phones can differentiate their products, there is limited potential to make consumers addicted to different brands of solar panels. Decisions to choose one panel type over another are based purely on cost.

One explanation for the fall in returns was the simple fact that there were not many barriers to entry in the manufacturing of solar panels and entry of more productive firms (mainly from China) put downward pressure on prices. An alternative possibility is that First Solar was earning high returns when the price of raw polysilicon was high and that the declines in the adjusted returns would not have occurred if the polysilicon price would remain have remained high. The fact that the whole industry was earning high returns and the issue was not specific to First Solar is demonstrated by computation of the return on invested capital for a polysilicon manufacturer -- The company is in a commodity business and has a good cost of production.

Even if the thin film manufacturing process was superior to other technologies such as polysilicon, the ultimate question would by why other companies would not enter the business and do essentially the same thing.

Why should make high return on the development. Solar does not have much risk during construction. If risks not high, should not get much of a premium relative to cost. For hydro plant where must construct an dam and perform civil works with tunnels and other items, the risks are much higher.

Graph of actual versus forecasted Operating Income.

Discuss the true competitive advantage. If competitive advantage, then other companies facing the same pricing pressure would have lower retruns.

Note how difficult the calculation is to be careful about earned returns.

Return on Net Assets (RONA) was the metric CFO Meyerhoff used to measure the financial performance of the company as it captured both P&L performance and capital efficiency. He further explained:

I look at my business as having four cost columns that must be managed: the module, EPC, development costs, and the WACC. We have intentionally underlevered at the corporate level, which means that my WACC is higher than it needs to be there. However, I get a much better WACC as a result for my projects. Then I can drive up my corporate asset turnover through more module sales and my margins increase because I don't have to pay as much for debt. Overall, I get a much better RONA this way than by lowering the corporate WACC.

Much of the case was about moving into different segment of the industry. Could become an EPC contractor. Could become developer. Along with this idea is the notion that solar can compete without subsidies.

Show the economics of solar power in different places.

Discuss the economics of solar power and the revolution.

First question is how to compute returns. Problem with ROE is that includes financing and cannot isolate on what returns are made from what company is really doing. Use Apple as example. The show ROE and ROIC for First Solar. With high subsidies, many people split. Use Spanish example where did not uphold contracts. Most importantly Chinese companies came into the industry quickly. Show the power house graph with arrow.

Not that simple. Rooftops need efficiency. Developing markets need cost of capital. High retail rates fight for policies that will not lose revenues. First Solar purchased a company that integrated solar arrays with balance of system components such as inverters, wiring, engineering and labor. First Solar paid $34.3 million for Turner. Then the company purchased Opti Solar, a troubled developer for $400 million in 2009 of which $250 was goodwill. In 2010 First Solar purchased projects from Edison Mission and it bought another company called Nextlight for $296.7 million. The company had no completed projects and a book value of (296.7-146.7). Nextlight was earning negative income before it was purchased.